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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1205

SURFACE TARGET PROJECTILE FUZES;
RESEARCH, DEVELOPMENT AND TESTS OF

24th Partial Report

- -

MARK 48 AND MARK 28 PROJECTILE FUZES;
BALLISTIC TEST OF

FINAL Report

Task Assignment NPG-Re2b-3-1-53

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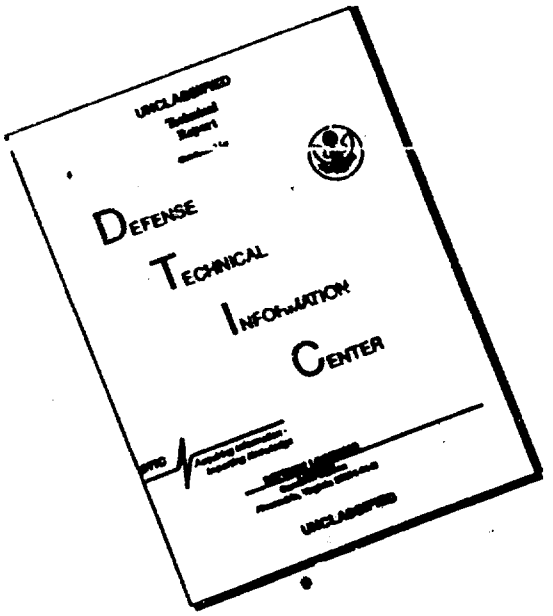

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Mark 48 and Mark 28 Projectile Fuzes; Ballistic Tests of

PART A

SYNOPSIS

1. This test was conducted in an attempt to demonstrate that: (1) premature fuze action could be induced in Mark 28 and Mark 48 fuzes modified to permit gas flow, (2) premature fuze action could not be induced in similarly modified fuzes with "O" ring seals and (3) Mark 28 and Mark 48 fuzes with solid base plugs and "O" rings would not function prematurely.

2. It is concluded that the Mark 28 and Mark 48 fuzes can be induced to fire prematurely by permitting gas to leak through the tracer cavity and enter the auxiliary plunger chamber. None of the fuzes containing "O" ring seals, including those fuzes modified to permit gas flow, detonated prematurely.

3. None of the limited number (50 rds.) of Mark 28 and Mark 48 fuzes with cut-off flanges, solid base plugs and "O" rings prematured in flight, and, from the general engineering aspect, this design appears to be less likely to premature than standard Mark 28 and Mark 48 base detonating fuzes.

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Mark 48 and Mark 28 Projectile Fuzes; Ballistic Tests of

PART B

INTRODUCTION

1. AUTHORITY:

This test was authorized by reference (a) under Task Assignment NPG-Re2b-3-1-53 and conducted in general accordance with references (b) through (k).

2. REFERENCES:

a. BUORD Conf ltr NP9 Re2b-DBLaP:bjn Ser 41887 of 10 July 1952
b. NOL Conf ltr NP/NOL/X1-1(2885) Ser 01592 of 22 July 1952
c. NOL Conf ltr NP/NOL/X1-1(3678) Ser 02480 FA:JSB:br of 13 November 1952
d. NOL Conf ltr NP/NOL/X1-1(3911) Ser 02728 FA:JSB:br of 12 December 1952
e. NOL Conf Work Request FA-37 of 21 August 1952
f. NOL Conf Work Request FA-56 of 6 January 1953
g. NOL Conf Work Request FA-57 of 14 January 1953
h. NOL Conf Work Request FA-58 of 3 February 1953
i. NOL Conf Work Request FA-68 of 18 February 1953
j. NOL Conf Work Request FA-71 of 4 March 1953
k. NOL Conf Work Request FA-79 of 24 April 1953

3. BACKGROUND:

a. Premature detonations have occurred in the fleet with 5", 8", and 16" projectiles, fuzed with Mark 48 and Mark 28 base detonating fuzes. Naval Ordnance Laboratory tests indicated that the prematures may have been caused by the passage of chamber gases past the fuze tracer cavity plug and retainer into the auxiliary plunger chamber of the fuze. The pressure of these trapped gases, upon fuze arming, would force the detonator plunger onto the firing pin and thus produce premature fuze action.

b. A method of sealing the fuze against gas entry, shown in Figure 1, has been devised by the Naval Ordnance Laboratory. This method utilizes an "O" ring placed around the modified tracer cavity plug at the bottom of the tracer cavity. All laboratory tests indicated that this "O" ring provided a satisfactory seal against chamber gases.

4. OBJECT OF TEST:

This test was conducted in an attempt to demonstrate that: (1) premature fuze action could be induced in Mark 28 and Mark 48 fuzes modified to permit gas flow, (2) premature fuze action could not be induced to similarly modified fuzes with "O" ring seals and (3) Mark 28 and Mark 48 fuzes with solid base plugs and "O" rings would not function prematurely.

5. PERIOD OF TEST:

a. Date Project Letter	22 July 1952
b. Date Commenced Test	17 September 1952
c. Date Completed Test	14 May 1953

6. REPRESENTATIVES PRESENT:

The following representatives witnessed various phases of this test:

Mr. J. S. Bartos	Naval Ordnance Laboratory
Mr. S. Globe	Naval Ordnance Laboratory
Mr. A. A. Burgess	Naval Ordnance Laboratory
Mr. A. P. Johnson	Naval Ordnance Laboratory
Mr. J. A. Templeton	Naval Ordnance Laboratory
Mr. H. E. Evans	Naval Ordnance Laboratory

PART C

DETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

a. Mark 28 and Mark 48 Base Detonating Fuzes - The fuzes of Phases I through IV were modified as indicated in Table I, Appendix (B), and in Figure 2. Table I also lists the modifications of the Phase V fuzes as shown in Figure 3. The fuzes tested in Phases VI and VII were modified as shown in Figure 4. The Phase VI and VII modifications consisted of removing the flange from the body and screwing a solid base plug into the tracer cavity. In addition an "O" ring was placed around the tracer cavity plug at the bottom of the tracer cavity to insure a gas seal if leakage occurred around the base plug.

b. The fuzes of Phases II through V contained a 33 millisecond delay placed in the explosive train to insure bore safety.

8. DESCRIPTION OF TEST EQUIPMENT:

a. Guns:
(1) 8"/35 Mark A Mod 1 No. 560L ESR 223-224
(2) 8"/55 Mark 15 Mod 2 No. 737 ESR 48-50
(3) 8"/55 Mark 15 Mod 0 No. 838 ESR 245-
(4) 5"/38 Mark 12 Mod 1 No. 5015 ESR 1102-
(5) 5"/38 Mark 12 Mod 1 No. 11249 ESR 1013-1014

b. Projectiles:
(1) 8" HC Mark 25 Mod 2 modified for Smoke Puff Test as shown in Figure 5.
(2) 8" HC Mark 25 Mod 2 token loaded with 1.32±.07 lbs of explosive "D" and epsom salts as shown in Figure 6.
(3) 5"/38 Common Mark 46 Mod 1 explosive "D" loaded to service weight by NAD McAlester in 1945.

c. Wads: In lieu of the standard cork and paper wads, pyrolin wads were used to retain the propellant charge in the cartridge case. Pyrolin burns readily and was therefore considered less likely to block the flow of gas into the fuze.

d. Targets: 1" STS, 3/4" STS, 1/2" STS and sand at 0° obliquity and approximately 500 ft. range.

9. PROCEDURE:

The modified fuzes were assembled to the test projectiles and fired at proof, service, and reduced pressures against targets or down river. Cameras and observers were stationed at advantageous positions in order to observe and designate the point of premature fuze action as well as the point of normal fuze functioning, whichever occurred.

10. RESULTS AND DISCUSSIONS:

a. The detailed results are shown in Appendix (C).

b. In Phase I, modified fuzes assembled to 8" Mk 25 Mod 2 projectiles modified for smoke puff were fired vs armor from 8"/35 and 8"/55 guns at 1830 f/s and 2775 f/s respectively. No fuze action was noted prior to or after target impact. It was believed that the smoke puff type test was not conclusive as fuze action (denoted by smoke puff action) may have occurred near the muzzle and have been obscured by the muzzle flash. Therefore, succeeding tests were conducted with token loaded 8" Mk 25 Mod 2 projectiles and fully loaded 5"/38 Mk 46 Mod 1 Common projectiles.

c. Phase II was conducted with modified Mk 28 BD fuzes assembled to 5"/38 Mk 46 Mod 1 projectiles. Rounds 1 through 12 were fired down river at reduced and service velocities and no premature fuze action was observed. In order to make certain that the fuze action had not been impaired by the modifications, round 13 was fired vs a 1/2" STS target and functioned satisfactorily approximately 30 feet behind the target. Rounds 14, 15 and 16 (fuze Nos. 16, 17 and 18) were then fired at service velocity down river and premature fuze action occurred approximately 100 feet from the muzzle. The modifications to fuze Nos. 16, 17 and 18 consisted of: (1) a 0"040 hole in the retainer, (2) a doubled over lead washer, (3) tracer plug threads combed to the minimum tolerance, (4) tracer plug seating pressure of five ft. lbs. and (5) no luting on the plug or retainer threads. These modifications differed from those of the previous fuzes tested in that the tracer plug seating torque was decreased and the plug threads were combed to minimum tolerances. Rounds 17 through 20 were then fired down river and no fuze action was observed. These fuzes contained the same modifications as fuze Nos. 16 through 18 except the hole through the retainer was 0"098 and 0"125 in diameter and an "O" ring was inserted around the bottom of the tracer plug.

d. Prior to conducting the tests of Phases III and V with token loaded 8" Mk 25 Mod 2 projectiles, static tests were conducted to determine the fragmentation characteristics of these projectiles. The beam spray (60°-120°), nose (0°) and base (180°) fragments are shown in Figures 7 and 8. From the results of these tests no exceptional presonnel hazard or material damage was anticipated.

e. The Mk 48 fuzes of Phase III were modified in a manner similar to the Mk 28 fuzes of Phase II. These fuzes were assembled to 8" Mk 25 token loaded projectiles and fired at reduced and service velocities versus 3/4" STS armor at 0° obliquity. Rounds 1 through 6 functioned high order in a conventional manner behind the target. Round 7 (fuze No. 128) prematured approximately 215 feet in front of the muzzle as shown in Figure 9. Fuze No. 128 contained modifications identical to those of Mk 28 fuze Nos. 16, 17 and 18 which prematured during the 5" tests of Phase II. Additional fuzes with identical modifications (Nos. 130 and 132) as well as other modified fuzes did not exhibit premature fuze action however. Fuze No. 136 which was modified in an identical manner to Nos. 128, 130, and 132, except for the addition of an "O" ring, did not premature and functioned in a conventional manner behind the target.

f. The Mk 28 fuzes of Phase IV were modified with more indirect routes for the gas flow. The holes through the retainers were off-center and the retainer threads were slotted through the threads parallel to the vertical axis. The fuzes were assembled to 5"/38 Mk 46 projectiles. Rounds 1 through 10 were fired down river at service velocity and no fuze action was observed. This firing indicated the possibility of detent damage during setback, by excessive gas pressure on the detonator plunger. Therefore rounds 11 and 12 were fired at service velocity versus 1/2" STS at 0° obliquity; they functioned high order approximately 45 ft. and 90 ft., respectively, behind the targets. In addition, rounds 13 and 14 were rendered inert and fired at service velocity into sand, recovered and returned to Naval Ordnance Laboratory for analysis.

g. In Phase V, modified Mk 48 fuzes were assembled to 8" Mk 25 token loaded projectiles and fired down river at service and reduced velocities. Rounds 1 through 5 were modified so that the time of gas flow past the retainer was the variable rather than the quantity of gas flow, which had been the previous variable. The ball check valve in the tracer plug was intended to open to permit gas flow into the fuze during setback and close after setback. The ball check valve in the retainer was fabricated to close during setback and open to permit gas flow past the retainer into the auxiliary plunger chamber after setback. Rounds 6 through 9 were fabricated in a manner similar to those tested prior to this phase except an effort was made to afford a less direct line of gas flow into the plunger chamber. None of the nine rounds tested exhibited premature fuze action.

h. The Mk 28 and 48 fuzes tested during Phases VI and VII were modified as shown in Figure 4. The fuzes were assembled to 5"/38 Mk 46 and 8" HC projectiles "D" loaded to service weight and fired at proof and reduced pressures down river for water impact. None of the fifty rounds fired prematured in flight. One 5" round and one 8" round fired at reduced velocities were duds on water impact.

PART D

CONCLUSIONS

11. a. It is concluded that the Mark 28 and Mark 48 fuzes can be induced to fire prematurely by permitting chamber gas to leak through the tracer cavity and enter the auxiliary plunger chamber. None of the fuzes containing the "O" ring seals, including those fuzes modified to permit gas flow, detonated prematurely.

b. None of the limited number (50 rds.) of Mk 28 and Mk 48 fuzes with cut-off flanges, solid base plugs and "O" rings prematured in flight, and, from the general engineering aspect, this design appears to be less likely to premature than standard Mk 28 and 48 base detonating fuzes.

Mark 48 and Mark 28 Projectile Fuzes; Ballistic Tests of

The tests upon which this report is based were conducted by:
R. D. CROMWELL, Plate Fuze Battery Officer
Terminal Ballistics Department

This report was prepared by:
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APPROVED: J. F. BYRNE
Captain, USN
Commander, Naval Proving Ground

E. A. RUCKNER
Captain, USN
Ordnance Officer
By direction

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NPG REPORT NO. 1205

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Twenty-Fourth Partial Report

on

Surface Target Projectile Fuzes;

Research, Development and Tests of

- -

Final Report

on

Mark 48 and Mark 28 Projectile Fuzes;

Ballistic Tests of

Project No.: NPG-Re2b-3-1-53
Copy No.: 10
No. of Pages: 9

Date: NOV 17 1953

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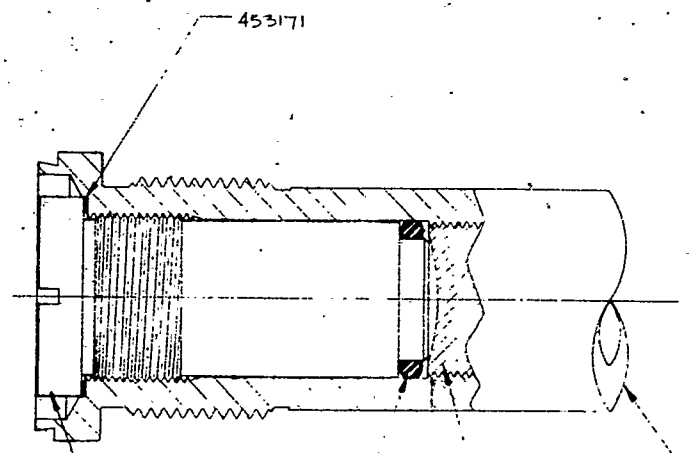

NOTES:

1. PROCEDURE TO BE FOLLOWED IN ASSEMBLY:
   - A. COAT O-RING WITH A LIGHT COATING OF SILICONE GREASE, DOW CORNING DC-3 OR DC-4 OR EQUIVALENT, AND INSERT INTO BOTTOM OF TRACER CAVITY.
   - B. PLACE LEAD GASKET, DR. 453171, UNDER LIP OF PLUG, SK. 354679.
   - C. COAT ALL THREADS OF PLUG WITH FUZE THREAD LUTING (UNDILUTED) MADE IN ACCORDANCE WITH NAVY DEPT. SPEC. 52 L 25 (ORD)
   - D. SCREW PLUG INTO TRACER CAVITY UNTIL IT SEATS AGAINST PLUNGER RETAINER PLUG, DR 330168-3, USING A TORQUE OF 40 FT. LBS. ±8 FT. LBS.
2. THIS ASSEMBLY DETAIL IS APPLICABLE TO PROJECTILE BASE DETONATING FUZES WHOSE DIMENSIONS ACCEPT THE TRACER MK 5 OR MK 9.

SK. 354678

Figure 1

[redacted]

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APPLICATION	

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FA	[redacted]	7-31-52
HD	[redacted]	7-31-52
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TRACER CAVITY & PLUG ASSEMBLY DETAIL

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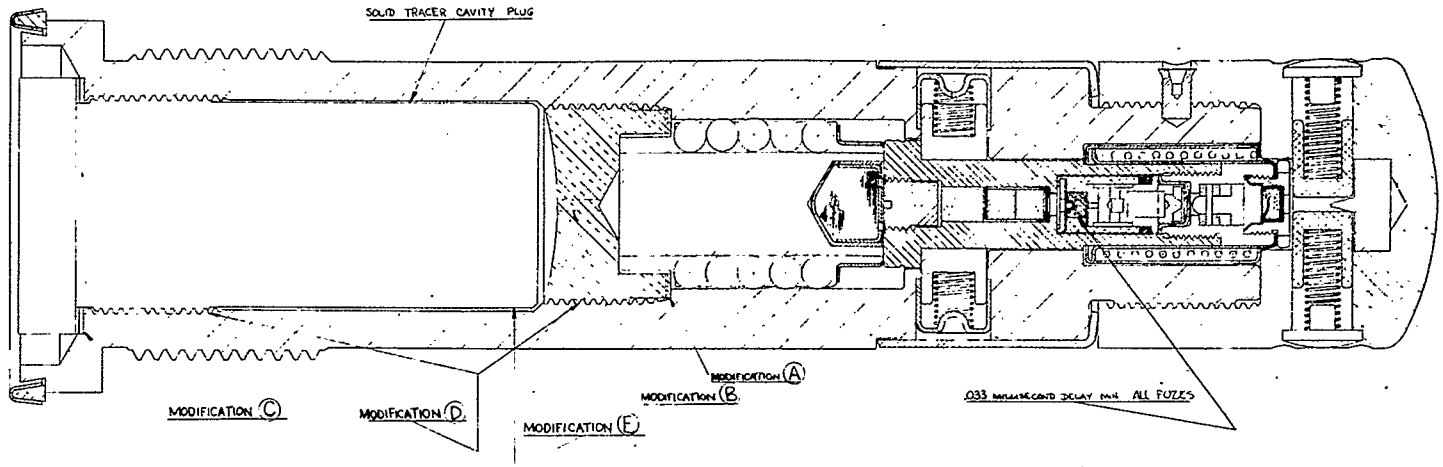
Figure 2



MODIFICATION (A) RETAINER SLOTTED AS SHOWN IN DETAIL, SLOTS TO VARY FROM .015" TO .025" DEEP

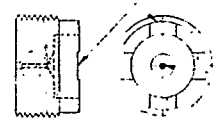
MODIFICATION (B) RETAINER DRILLED LONGITUDINALLY AS SHOWN IN DETAIL HOLES TO VARY FROM .028" TO .040 DIA

MODIFICATION (C) LEAD WASHER IN TRACER CAVITY DOUBLED OVER.

MODIFICATION (D) LUTTING ON TRACER CAVITY PLUG AND RETAINER THREADS TO BE OMITTED

MODIFICATION (E) "O" RING GAS SEAL PROVIDED AS SHOWN ON BU.ORD. SK NO. 554678

GENERAL EXACT MODIFICATIONS TO BE NOTED ON A FUZE DETAIL LIST SHOWING CHARACTERISTICS OF EACH FUZE FURNISHED FOR TESTS. DRAWING SHOWS ALL MODIFICATIONS THAT WILL BE EMPLOYED AND DOES NOT REPRESENT MADE-UP OF ANY ONE FUZE.



RETAINER

5"/38 FIRING TESTS – Mk 28 BASE FUZE WITH Mk 35 OR Mk 46 COMMON PROJECTILES.

8"/55 FIRING TESTS – Mk 48 BASE FUZE WITH Mk 25 MC PROJECTILES LOADED AS SHOWN ON BU ORD SK. No. 482200

Mk 28 & 48 FUZE ARRANGEMENT FOR PREMATURE TESTS

1358873

7263-14

1659811

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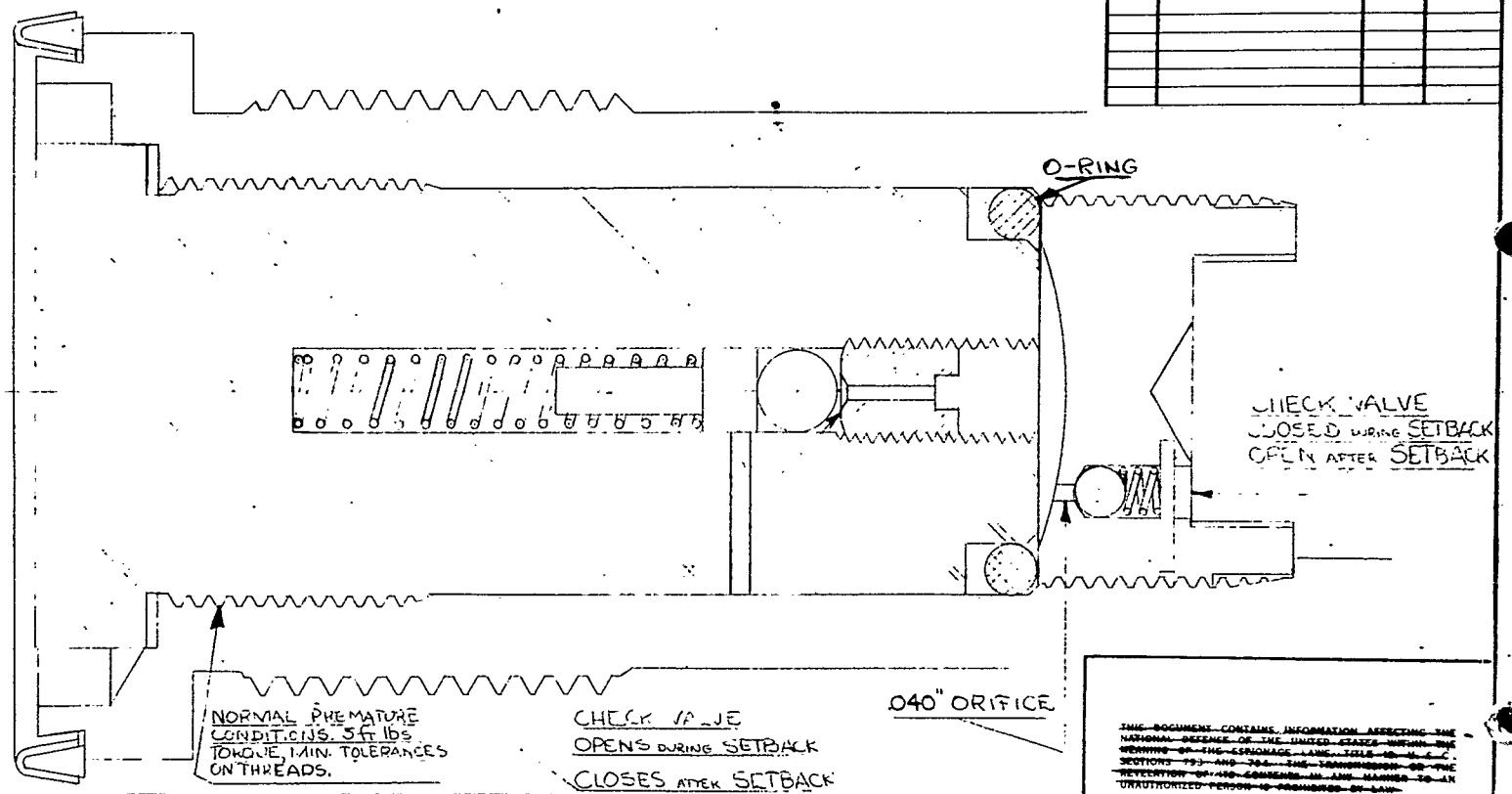

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TRACER CAVITY PLUG AND RETAINING PLUG ARRANGEMENT - Mk 48 BASE FUZE

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Figure 4

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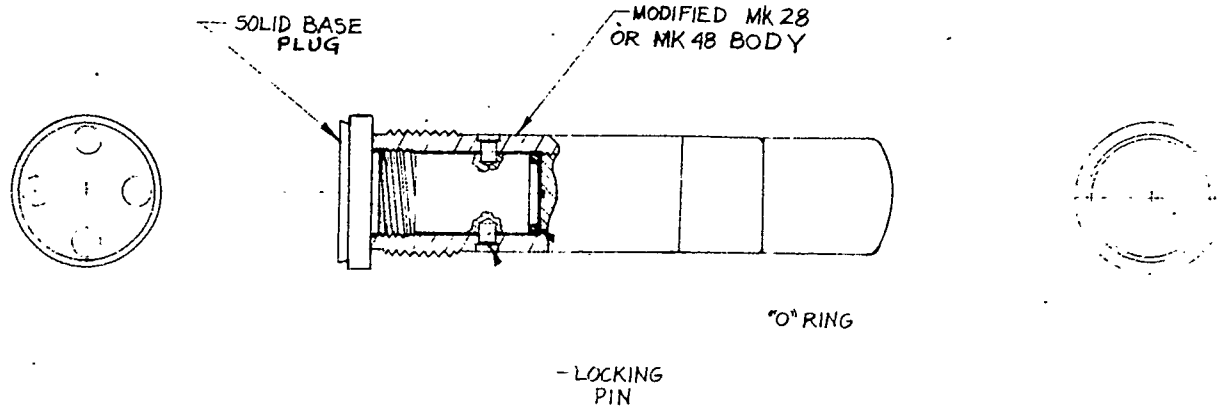

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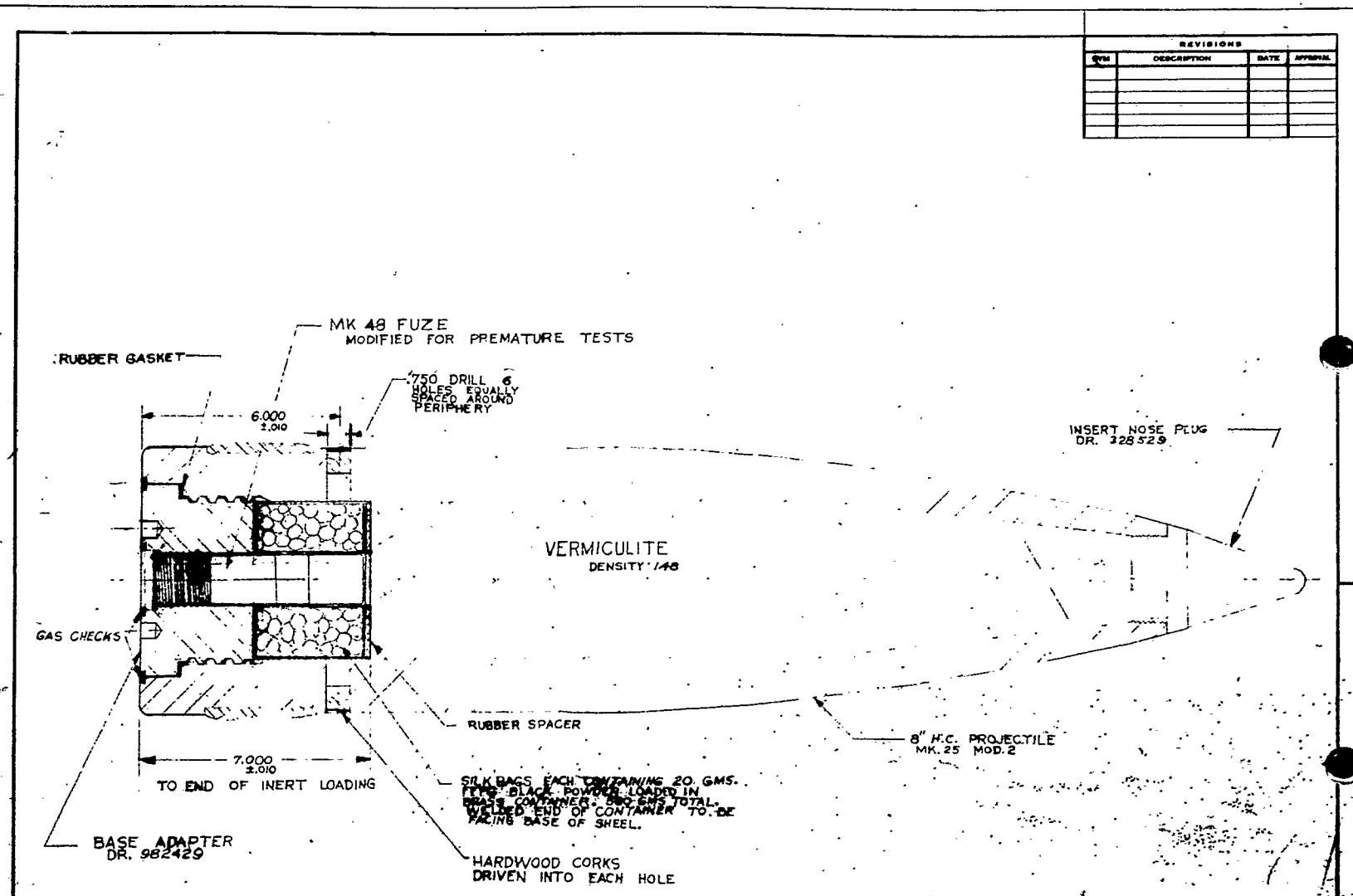
Figure 5



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SMOKE PUFF TEST FOR MK. 48 FUZE

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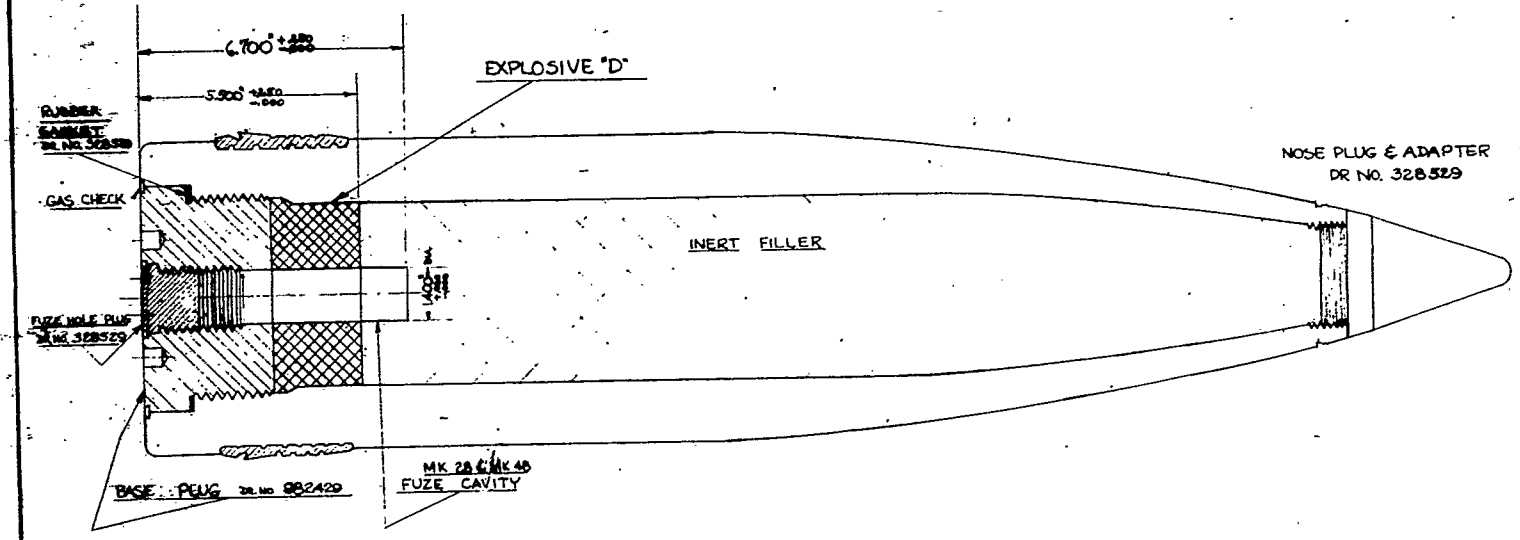
SK 354596

Figure 6



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8" H.C. PROJECTILE
MK 25 MOD 2
TOKEN LOAD FOR FUZE TESTING

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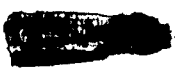
DRAWING SHEET PRINC-NOL-5301 C REV. (12-51)

T283-1.4

FRAG NO. 1698 — N.P.G. NO. 51883

8" HC TOKEN LOADED WITH EXPLOSIVE "D"

	RD-1, WATER PIT TEST 60°-120° FRAGMENTS.	RD-2, WATER PIT TEST 60° - 120° FRAGMENTS.
0 - 5/8	Gms.	
2	Pcs.	9
.5	Gms.	3.1
5/8 - 1 1/4	Gms.	
4	PCS.	4
4	Gms.	4
1 1/4 - 2 1/2	Gms.	
6	PCS.	2
13	Gms.	4
2 1/2 - 5	Gms.	
6	PCS.	2
20	Gms.	7
5 - 10	Gms.	
4	PCS.	
24	Gms.	
10 - 20	Gms.	
6	PCS.	
88	Gms.	
20 - 40	Gms.	
2	PCS.	1
66	Gms.	25
40 - 80	Gms.	
3	PCS.	2
203	Gms.	89
80 - 160	Gms.	
	PCS.	1
	Gms.	104
160 - 320	Gms.	
	PCS.	3
	Gms.	747



2402 Gms.

4323 Gms.

350 Gms.

1657 Gms.

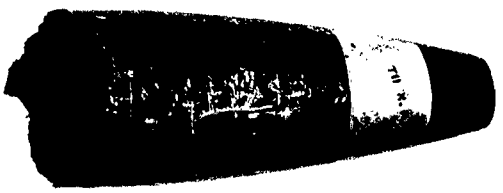
799 Gms.

582 Gms.

0° FRAGMENT.

118½ LBS.

0° FRAGMENT.



116½ LBS.

SCALE 1"

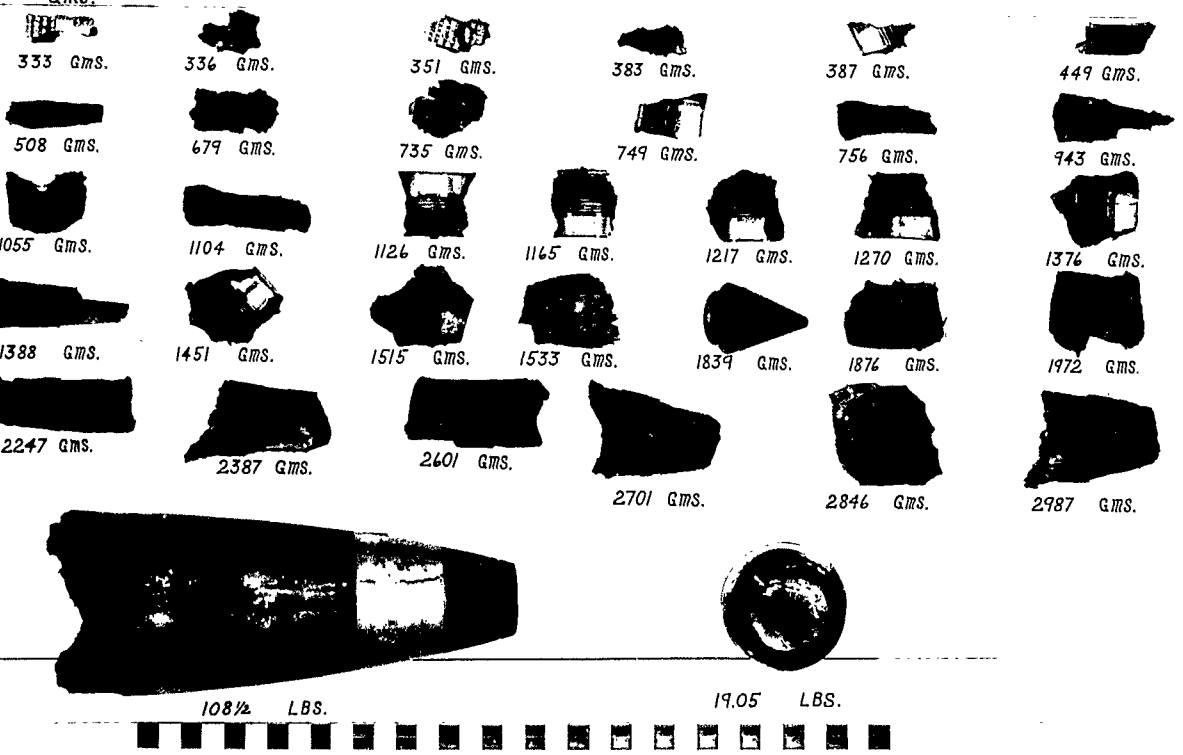
NPG-51883 — 29 December 1952 — CONFIDENTIAL SECURITY INFORMATION

Water Pit Recovery and 0° Fragment of Token loaded 8" HC Projectiles

FIGURE 7

FRAG. NO. 1697 — 8" HC. TOKEN [redacted] ADED WITH EXPLOSIVE "D" DETONATED [redacted] N SAWDUST. — NPG NO. 51896

0 - 5/8	Gms.	
	PCS.	
43	Gms.	
5/8 - 1¼	Gms.	
33	PCS.	
28	Gms.	
1¼ - 2½	Gms.	
3	PCS.	
6	Gms.	
2½ - 5	Gms.	
8	PCS.	
29	Gms.	
5 - 10	Gms.	
10	PCS.	
77	Gms.	
10 - 20	Gms.	
13	PCS.	
88	Gms.	
20 - 40	Gms.	
6	PCS.	
71	Gms.	
40 - 80	Gms.	
15	PCS.	
881	Gms.	
80 - 160	Gms.	
11	PCS.	
1241	Gms.	
160 - 320	Gms.	
17	PCS.	
4050	Gms.	
FUZE - FRAGS.		
10	PCS.	
279	Gms.	



NP9-64187 24 January 1953 CONFIDENTIAL
SECURITY INFORMATION

Mark 48 BD Fuze No. 128 assembled to 8" Mark 25 token loaded projectile fired at service velocity. Note premature fuze action approximately 215 feet from the muzzle. Round 7.

Figure 9

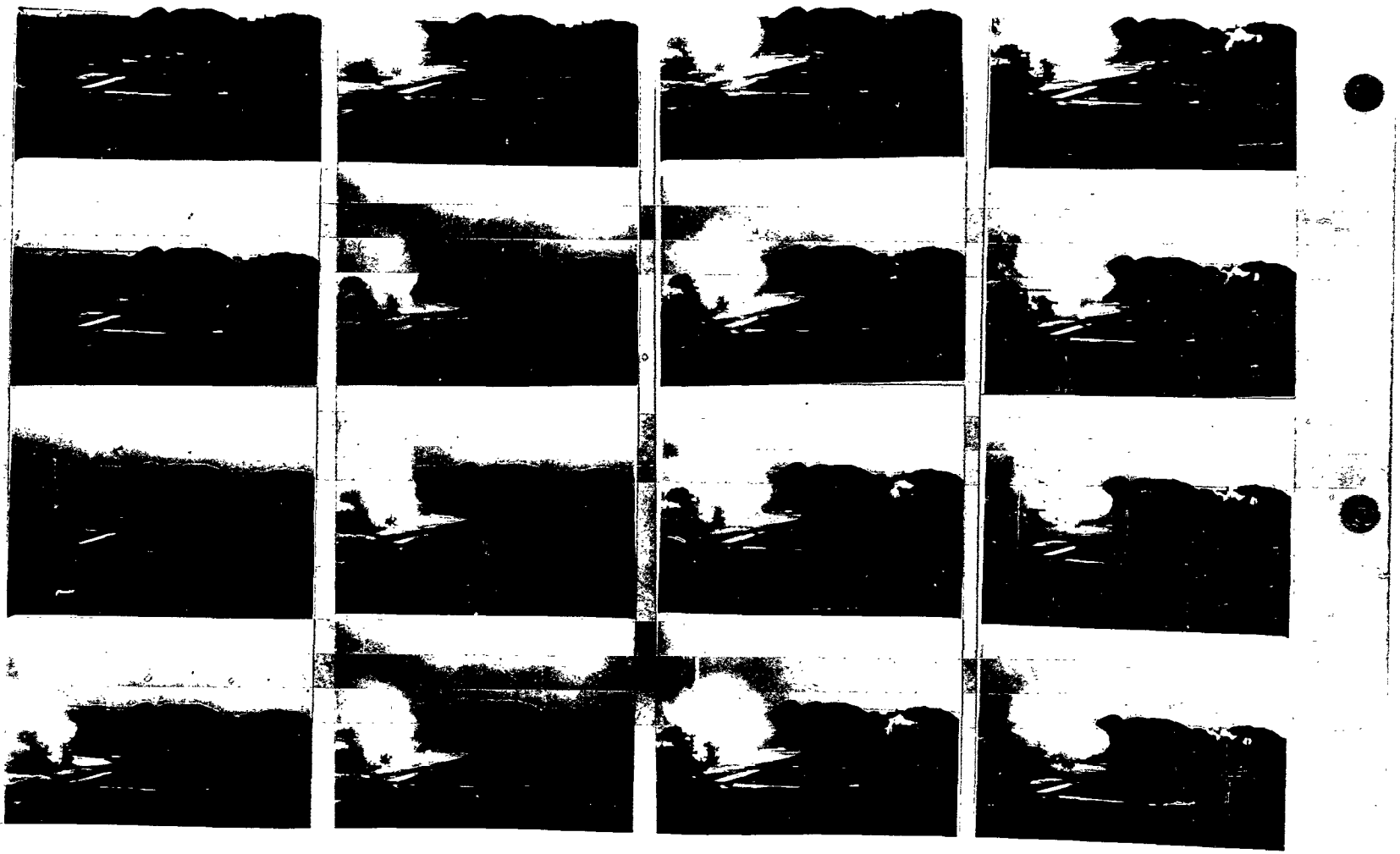


TABLE I

FUZE MODIFICATION CHART

Phase No.	Fuze No.	Cal.	MOD A Depth of 0".250 Wide Slots of Ret.	MOD B Size Hole in Ret.	MOD C 0".025 Lead Washer	Retainer Thr.	Retainer Torque Ft. Lbs.	Tracer Cav. Plug Thr.	Tracer Cav. Plug Torque Ft. Lbs.	MOD D Luting	MOD E "O" Ring
I	1	8"	None	0".040	D.O.	w/t	30	w/t	30	Yes	None
"	2	"	"	"	"	"	"	"	"	"	"
"	3	"	"	"	"	"	"	"	"	"	"
"	8	"	"	0".125	"	"	"	"	"	"	"
"	9	"	"	"	"	"	"	"	"	"	"
"	10	"	"	"	"	"	"	"	"	"	"
II	1	5"	"	None	"	"	25	"	"	On Ret. Only.	"
"	2	"	"	"	"	"	"	"	"	None	"
"	3	"	"	"	"	"	"	"	"	"	"
"	4	"	"	"	"	"	"	"	"	"	"
"	5	"	0".015	"	"	"	"	"	"	On Ret. Only.	"
"	6	"	"	"	"	"	"	"	"	None	"
"	7	"	0".018	"	"	"	"	"	"	"	"
"	8	"	"	"	"	"	"	"	"	"	"
"	9	"	0".025	"	"	"	"	"	"	"	"
"	10	"	"	"	"	"	"	"	"	"	"
"	11	"	None	0".028	"	"	"	"	"	"	"
"	12	"	"	0".040	"	"	"	"	"	"	"
"	13	"	0".025	None	"	"	"	"	"	"	Yes
"	16	"	None	0".040	"	"	"	Comb.	5	None	None
"	17	"	"	"	"	"	"	"	"	"	"
"	18	"	"	"	"	"	"	"	"	"	"
"	22	"	"	0".098	"	"	"	"	"	"	Yes
"	23	"	"	"	"	"	"	"	"	"	"
"	24	"	"	0".125	"	"	"	"	"	"	"
"	25	"	"	"	"	"	"	"	"	"	"

TABLE I (Continued)

Phase No.	Fuze No.	Cal.	MOD A Depth of 0".250 Wide Slots of Ret.	MOD B Size Hole in Ret.	MOD C 0".025 Lead Washer	Retainer Thr.	Retainer Torque Ft. Lbs.	Tracer Cav. Plug Thr.	Tracer Cav. Plug Torque Ft. Lbs.	MOD D Luting	MOD E "O" Ring
III	116	8"	None	None	D.O.	w/t	25	w/t	30	On Ret. Only	None
"	117	"	"	"	"	"	"	"	"	None	"
"	118	"	"	"	"	"	"	Comb.	5	"	"
"	123	"	0".018	"	"	"	"	"	"	"	"
"	124	"	0".025	"	"	"	"	"	"	"	"
"	125**	"	"	"	"	"	"	"	2	"	"
"	126	"	None	0".028	"	"	"	"	5	"	"
"	127	"	"	"	"	"	"	"	"	"	"
"	128	"	"	0".040	"	"	"	"	"	"	"
"	130	"	"	"	"	"	"	Comb.	"	"	"
"	131	"	"	"	"	"	"	"	30	"	"
"	132	"	"	"	"	"	"	w/t	5	"	"
"	133	"	"	"	"	"	"	"	30	"	"
"	136	"	"	"	"	"	"	"	5	"	Yes
"	137	"	"	"	"	--	--	"	"	"	"
"	139	"	"	0".125	"	--	--	"	"	"	"
"	140	"	"	"	"	--	--	"	"	"	"
IV	26	5"	"	0".0400.C.	"	w/t	10	Comb.	"	"	"
"	27	"	"	"	"	Comb.	5	"	"	"	"
"	28	"	0".020 0".035x030S.S.	None	"	w/t	10	"	20	"	"
"	29	"	0".020 0".035x030S.S.	"	"	"	5	"	5	"	"
"	30	"	0".025 0".035x030S.S.	"	"	"	"	"	"	"	"
"	31	"	0".020	"	"	Comb.	"	"	"	"	"
"	32	"	"	"	"	"	2	"	"	"	"
"	33	"	0".025	"	"	Comb.*** (-".005)	"	"	"	"	"
"	34	"	"	"	"	Comb. (-".010)	"	"	"	"	"

TABLE I (Continued)

Phase No.	Fuze No.	Cal.	MOD A Depth of 0".250 Wide Slots of Ret.	MOD B Size Hole in Ret.	MOD C 0".025 Lead Washer	Retainer Thr.	Retainer Torque Ft. Lbs.	Tracer Cav. Plug Thr.	Tracer Cav. Plug Torque Ft. Lbs.	MOD D Luting	MOD E "O" Ring
IV	35	5"	0".020	None	D.O.	Comb. (-".015)	2	Comb.	5	None	Yes
"	36	"	"	"	"	Comb. (-".020)	"	"	2	"	"
"	37	"	None	"	"	Comb. (-".010)	-1/4T	"	"	"	"
"	38	"									
"	39	"									

** 125 - Tracer plug was hand seated, it protruded from base 0".040 - 0".050.

*** Comb.(-".005) = combed 0".005 under minimum Tolerances.

TABLE I (Continued)

Phase No.	Fuze No.	Retainer Thr.	Retainer Torque Ft. Lbs.	Retainer B.C.V.	Retainer MOD B	Retainer MOD A	Tracer Cavity Plug Threads	Tracer Cavity Plug Torque Ft. Lbs.	Tracer Cavity Plug B.C.V.	Luting	"O" Ring	0"025 Lead Washer
V	141	w/t	40	Yes	0"040 O.C.	---	Comb.	5	Yes	Ret. Only	None	D.O.
"	143	"	"	"	0"055 O.C.	---	"	"	"	" "	"	"
"	145	"	"	"	0"075 O.C.	---	"	"	"	" "	"	"
"	146	"	"	"	0"040 O.C.	---	"	"	No	" "	"	"
"	147	"	"	"	0"055 O.C.	---	"	"	"	" "	"	"
"	149	"	"	No	0"040 O.C.	---	"	"	"	None	"	"
"	150	"	"	"	---	0"020 0"035x0"030S.S.	"	10	"	"	"	"
"	152	Comb.	"	"	---	0"020	Comb.	5	"	"	"	"
"	153	Comb. (-"020)	"	"	---	0"020	"	"	"	"	"	"

Thr. = threads
D.O. = doubled over
w/t = with tolerances
ss = side slots passing through threads parallel to longitudinal axis
O.C. = off center
-1/4T = hand seated and backed off 1/4 turn
Comb. = threads combed to minimum tolerances
Ret. = retainer
B.C.V. = Ball check value

TABLE II

DETAILED FIRING RECORD

PHASE I

Date	Gun No.	Rd. No.	Fuze No.	Muzzle Velocity (f/s)	Target Mat.	Target Obl.	Target Range	Fuze* Action
9-17-52	560L	1	1	1836	3/4" STS	0°	500 ft.	NFA
"	"	2	2	1827	" "	"	"	"
"	"	3	3	1830	" "	"	"	"
10-1-52	737	4	8	2808	1" STS	"	"	"
"	"	5	9	--	" "	"	"	"
"	"	6	10	2767	" "	"	"	"

*Fuze Action: NFA = no fuze action (smoke puff) observed.

Guns: 8"/35 Mark A Mod 1 Gun No. 560L
8"/55 Mark 15 Mod 2 Gun No. 737

Fuze: Mark 48

TABLE II (Continued)

PHASE II

Date	Rd. No.	Fuze No.	Chamber Pressure T/in^2	Approx. Muzzle Velocity (f/s)	Target Mat.	Target Obl.	Target Approx. Range	Fuze* Action
12-24-52	1	1	13.4	2600	Down River		11,000 yds.	NFA
"	2	2	16.2	2600	"	"	11,000 yds.	"
"	3	3	5.9	1200	"	"	6,000 yds.	"
"	4	4	15.0	2600	"	"	11,000 yds.	"
"	5	5	5.9	1200	"	"	6,000 yds.	"
12-29-52	6	6	5.8	1200	"	"	6,000 yds.	"
"	7	7	14.9	2600	"	"	12,000 yds.	"
"	8	8	5.8	1200	"	"	6,000 yds.	"
"	9	9	15.0	2600	"	"	12,000 yds.	"
"	10	10	5.9	1200	"	"	6,000 yds.	"
"	11	11	15.1	2600	"	"	12,000 yds.	"
"	12	12	5.9	1200	"	"	6,000 yds.	"
1-2-53	13	13	16.0	2600	1/2" STS	0°	500 ft.	HO-30 ft. behind target
1-12-53	14	16	15.3	2600	Down River		12,000 yds.	Prem. - 100 ft.
"	15	17	15.7	2600	"	"	12,000 yds.	Prem. - 100 ft.
"	16	18	15.4	2600	"	"	12,000 yds.	Prem. - 100 ft.
"	17	22	15.6	2600	"	"	12,000 yds.	NFA
"	18	23	15.4	2600	"	"	12,000 yds.	"
"	19	24	16.1	2600	"	"	12,000 yds.	"
"	20	25	15.3	2600	"	"	12,000 yds.	"

*Fuze Action: NFA = no fuze action observed on water impact.
HO = high order detonation.
Prem. - 100 = premature fuze action 100 ft. from gun muzzle.

Gun: 5"/38 Mark 12 Mod 1 Gun No. 5015

Fuze: Mark 28

TABLE II (Continued)

PHASE III

Date	Rd. No.	Fuze No.	Chamber Pressure T/in^2	Approx. Muzzle Velocity (f/s)	Target Mat.	Target Obl.	Target Range	Fuze* Action
1-22-53	1	116	10.8	2200	3/4" STS	0°	450 ft.	HO behind target.
"	2	117	11.4	"	"	"	"	" " "
"	3	118	11.5	"	"	"	"	" " "
"	4	123	11.7	"	"	"	"	" " "
"	5	126	11.8	"	"	"	"	" " "
1-24-53	6	127	12.0	"	"	"	"	" " "
"	7	128	14.4	Service	"	"	"	Premature - 215 ft.
"	8	124	14.6	"	"	"	"	HO behind target.
"	9	136	14.9	"	"	"	"	" " "
"	10	137	14.7	"	"	"	"	LO behind target.
"	11	139	14.6	"	"	"	"	HO behind target.
"	12	140	14.0	"	"	"	"	Dud
"	13	133	14.7	"	"	"	"	HO behind target.
"	14	132	14.7	"	"	"	"	Dud
"	15	131	14.2	"	"	"	"	LO on water impact, dud on target
"	16	125	14.5	"	"	"	"	HO behind target
"	17	130	14.5	"	"	"	"	" " "

*Fuze Action: HO = high order detonation.
LO = low order detonation.
Dud = no fuze action.
Premature - 215 ft. = premature fuze action 215 ft. from the muzzle.

Gun: 8"/55 Mark 15 Mod 0 No. 838.

Fuze: Mark 48

TABLE II (Continued)

PHASE IV

Date	Rd. No.	Fuze No.	Chamber Pressure T/in^2	Approx. Muzzle Velocity (f/s)	Target Mat.	Target Obl.	Target Range	Fuze Action
2-17-53	1	26	14.4	2600	Down River		12,000 yds.	NFA
"	2	27	15.4	"	"	"	"	"
"	3	28	15.0	"	"	"	"	"
"	4	29	--	"	"	"	"	"
"	5	30	15.2	"	"	"	"	"
"	6	33	15.1	"	"	"	"	"
"	7	34	14.4	"	"	"	"	"
"	8	35	--	"	"	"	"	"
"	9	36	15.0	"	"	"	"	"
"	10	37	15.0	"	"	"	"	"
2-20-53	11	31	15.0	"	1/2" STS	0°	450 ft.	HO-45 ft. behind target.
"	12	32	15.0	"	"	"	"	HO-90 ft. behind target.
2-24-53	13	39	14.4	"	Sand	"	"	For recovery.
"	14	38	--	"	1" STS	"	"	" "

Gun: 5"/38 Mark 12 Mod 1 Gun No. 5015

Fuze: Mark 28

TABLE II (Continued)

PHASE V

Date	Rd. No.	Fuze No.	Chamber Pressure T/in^2	Approx. Muzzle Velocity (f/s)	Target			Fuze* Action
					Mat.	Obl.	Approx. Range	
3-17-53	1	141	14.1	2800	Down	River	12,000 yds.	NFA
"	2	143	14.4	2800	"	"	"	"
"	3	145	11.8	2200	"	"	"	"
"	4	146	13.2	2200	"	"	"	"
"	5	147	14.4	2800	"	"	16,000 yds.	"
"	6	149	14.6	2800	"	"	"	"
"	7	152	14.8	2800	"	"	"	"
"	8	153	13.4	2200	"	"	12,000 yds.	"
"	9	150	14.3	2800	"	"	16,000 yds.	"

*Fuze Action: NFA = no fuze action observed.

Gun: 8"/55 Mark 15 Mod 0 Gun No. 838

Fuze: Mark 48

TABLE II (Continued)

PHASE VI

Date	Rd. No.	Chamber Pressure T/in^2	Approx. Muzzle Velocity (f/s)	Target Mat.	Target Obl.	Target Range	Fuze* Action
5-5-53	1	--	1200	Down	River	5,000 yds.	HOWI
"	2	19.8	Proof	"	"	12,000 yds.	"
"	3	20.1	"	"	"	"	"
"	4	19.9	"	"	"	"	"
"	5	20.2	"	"	"	"	"
"	6	--	1200	"	"	5,000 yds.	HOWI
"	7	--	"	"	"	"	"
"	8	--	"	"	"	"	"
"	9	--	"	"	"	"	"
5-6-53	10	--	"	"	"	"	Not observed
"	11	19.8	Proof	"	"	12,000 yds.	"
"	12	20.9	"	"	"	"	HOWI
"	13	--	1200	"	"	5,000 yds.	"
"	14	--	"	"	"	"	"
"	15	--	"	"	"	"	Dud
"	16	20.8	Proof	"	"	12,000 yds.	HOWI
"	17	20.5	"	"	"	"	"
"	18	21.2	"	"	"	"	"
5-11-53	19	--	1200	"	"	5,000 yds.	HOWI
5-14-53	20	19.2	Proof	"	"	12,000 yds.	"
"	21	20.5	"	"	"	"	"
"	22	20.6	"	"	"	"	"
"	23	20.8	"	"	"	"	"
"	24	20.8	"	"	"	"	Not observed
"	25	20.7	"	"	"	"	HOWI

*Fuze Action: HOWI = high order detonation on water impact
Dud = no fuze action
Not observed = fuze functioning or projectile impact was not observed by look-out personnel owing to poor range - visibility.

Gun: 5"/38 Mark 12 Mod 0 Gun No. 5015

Fuze: Mark 28

TABLE II (Continued)

PHASE VII

Date	Rd. No.	Chamber Pressure T(in^2)	Approx. Muzzle Velocity (f/s)	Target			Fuze* Action
				Mat.	Obl.	Approx. Range	
7-1-53	1	11.5	2200	Down River		10,000 yds.	HOWI
"	2	17.8	Proof	"	"	15,500 yds.	"
"	3	12.3	2200	"	"	10,000 yds.	"
7-2-53	4	11.7	2200	"	"	"	"
"	5	18.3	Proof	"	"	16,200 yds.	"
"	6	21.6	Proof	"	"	"	"
"	7	12.1	2200	"	"	10,000 yds.	"
7-8-53	8	11.5	2200	"	"	"	"
"	9	22.0	Proof	"	"	16,500 yds.	"
"	10	22.4	Proof	"	"	"	"
"	11	22.0	Proof	"	"	"	"
"	12	11.1	2200	"	"	10,000 yds.	Dud
"	13	22.0	Proof	"	"	16,500 yds.	HOWI
"	14	21.7	Proof	"	"	"	"
"	15	22.7	Proof	"	"	"	"
"	16	11.2	2200	"	"	10,000 yds.	"
"	17	21.8	Proof	"	"	16,500 yds.	"
7-9-53	18	11.5	2200	"	"	10,000 yds.	"
"	19	20.6	Proof	"	"	16,000 yds.	"
"	20	21.1	Proof	"	"	"	"
"	21	21.7	Proof	"	"	"	"
"	22	11.6	2200	"	"	10,000 yds.	"
"	23	20.6	Proof	"	"	16,000 yds.	"
"	24	21.3	Proof	"	"	"	"
"	25	11.8	2200	"	"	10,000 yds.	"

*Fuze Action: HOWI = high order detonation on water impact
Dud = no fuze action.

Gun: 8"/55 Mark 15 Mod 0 Gun No. 838

Fuze: Mark 48